RELIABILITY & H.V. EQUIPMENT DEPARTMENT

Main Technical Requirements

For 161 kV

SURGE ARRESTERS

February 2026

	Name	Signature	Date
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Requirements for purchase, installation and connection to the Israeli grid

The purchase of equipment, its installation, or its integration into the electricity sector in Israel shall be permitted solely upon receipt of prior written approval from NOGA-ISO (for private customers, within the framework of the technical coordination process, and, with respect to the Israel Electric Corporation - written approval), confirming that the System Requirements Document - as published and updated from time to time on NOGA-ISO's official website - has been fully complied with by the purchaser, and further subject to the submission, in full, of all required technical materials, information, and accompanying documents, as detailed in the System Requirements Document, and upon completion of a formal, full, and final examination and approval, to the sole satisfaction of NOGA-ISO.

MAIN TECHNICAL REQUIREMENTS FOR 132 KV SURGE ARRESTERS

Scope of work:

This document describes the System data and the main Surge Arresters components, focusing on the threshold requirements.

Its primary purpose is to serve as a technical compulsory guideline for parties involved in preparing a detailed specification for a Surge Arresters that complies with applicable local regulations and the Purchaser's requirements in the Israel grid.

Notes:

1. *This document adopts the IEC 60099-4 as the primary international standard governing Surge Arresters.*
2. *The technical data, procedures, and requirements specified herein shall be regarded as part of the System's Threshold Requirements.*
3. *The final Surge Arresters Specification shall be jointly reviewed by the Customer and the Manufacturer to define the detailed design of each component, in accordance with the Israel Grid Code requirements* https://www.noga-iso.co.il/pdt/grid-code/.
4. *In cases where certain components lack the required documentation or fail to meet NOGA-ISO's technical requirements, the equipment or the affected parts may be disqualified for use.*
5. ***This document must be approved and signed by:***
   - *5.1. End Customer or his representative*
   - *5.2. The entity responsible for preparing the Surge Arresters specification (if applicable)*
   - *5.3. Surge Arresters manufacturer*

The Customer shall be responsible for providing all data and information requested in this document, and for ensuring that all technical requirements are fully met by the Manufacturer in the final supplied product.
The Customer is also responsible for verifying the accuracy and validity of all data submitted by the Manufacturer.

Project Name:				
Spec. No.				
No. of units:				
	Name	**Company & country**	**Date**	**Sign**
End-Customer or his representative				
Entity responsible for preparing the Surge Arresters spec.				
Manufacturer				

General:

- **Location:** This document covers the installation of Surge Arresters indoors or outdoors.
- The applicable standards are included in the respective clauses of this document.
- **Required Information and Documentation:** Requirements about documentation are in Clause 6.
- All clauses must be addressed. Only a specific ***data value***, confirmation of compliance with the requirement (***Complies***), or indication that the requirement is not applicable (***N/A***) will be accepted.

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SYSTEM REQUIREMENTS FOR 132kV SURGE ARRESTERS

1. GENERAL

1.1. **Type:** 132kV Surge Arresters.
1.2. **Location:** Outdoor installation (AIS).
1.3. **Required information and documentation:** see following clause 6 'Required documents'.
1.4. **Applicable standards:** see following table, next to the appropriate standard and required value.

2. ENVIRONMENT CONDITIONS

TECHNICAL REQUIREMENTS		
	Description	**Required Value or Applicable Standard**
2.1.	Environmental parameters according to IEC 60721-3-4/2019	4K26,4Z5,4S13, C5(clause 5.5)
2.1.1.	Chemically active substances: corrosively category C5	According to ISO 9223
2.1.2.	Minimum ו Maximum	-5 | +50 [°C]
2.1.3.	Yearly average	+27 [°C]
2.1.4.	Monthly average	+37 [°C]
2.1.5.	Spraying water and water jets with water velocity	15 m/sec
2.2.	Seismicity of site:	IEEE 693 & Israeli Standard 413
2.2.1.	Peak horizontal (x, y directions) ground acceleration with an 85% probability not to be exceeded over a 50 years period	0.5g
2.3.	Pollution Conditions	IEC 60815-1
2.3.1.	Pollution severity type	B
2.3.2.	site pollution severity (SPS) class	e (very heavy)
2.4.	Permissible altitude over the sea level	1000 m
2.5.	The equipment shall be vermin proof	

3. RATINGS

TECHNICAL REQUIREMENTS		
	Description	**Required Value**
3.1. System Conditions		
3.1.1.	Rated system voltage (line to line)	161 kV
3.1.2.	Highest system voltage (line to line)	170 kV
3.1.3.	Rated phase-to-earth voltage	93 kV
3.1.4.	System neutral	effectively earthed
3.1.4.1.	Temporary overvoltage with duration not more than1 sec (load rejection + earth fault) (p.u.)	1.4
3.1.5.	Frequency	50 Hz
3.1.6.	Symmetrical short circuit current not less than	50 kA r.m.s.
3.1.7.	Single phase short circuit current not less than	50 kA r.m.s.
3.1.8.	Rated peak withstands current	125 kA peak
3.1.9.	Rated duration of short circuit	1 sec
3.1.10.	Insulation level	
3.1.10.1.	power-frequency withstand voltage	325 kV
3.1.10.2.	lightning impulse withstand voltage	750 kV
3.1.11.	Line insulation (critical flashover 1.2/50 μs wave)	1350 kV
3.1.12.	Length of line up to	200 Km
3.2. Electrical Requirements from SA		
3.2.1.	Rated arrester voltage. (Ur)	132 kV
3.2.2.	Continuous operating voltage (Uc)	106-108 kV
3.2.3.	Maximum residual voltage at 8/20 μs lightning impulse current	
3.2.3.1.	20 kA (peak)	
3.2.4.	Arrester classification [Table 1 acc. to IEC 60099-4/2014]	Station type
3.2.4.1.	Designation	SH
3.2.4.2.	Nominal discharge current not be less than (KA)	20
3.2.4.3.	Switching impulse discharge current (kA)	2
3.2.4.4.	repetitive charge transfer rating Qrs(C) ≥	2.4
3.2.4.5.	thermal energy rating Wth(kj/kV) ≥	10
3.3. Function		
3.3.1.	Pressure-relief device of an arrester should be existing if the gas filled gap between the MO resistors and the housing	
3.3.2.	Grading ring of an arrester should be existing if the length of the SA about two meters and above	
3.3.3.	If exists monitoring device, Surge counters, monitoring spark gaps, Leakage current indicators should be existing insulating base	
3.4. Housing		
3.4.1.	Terminals aluminum or silver or silver-plated aluminum	
3.4.2.	creepage distance phase to ground not less than	53.7 mm/kV (5270 mm)
3.4.2.1.	Minimum arcing distance	1500 mm
3.4.3.	Minimum specified short time load (SSL)	5500 N
3.4.4.	Minimum specified long-term load (SLL)	2200 N
3.4.5.	Guaranteed mean value of breaking load (MBL) 120% SSL not less than	6600 N

TECHNICAL REQUIREMENTS		
	Description	**Required Value**
3.4.6.	Torsional strength (Nm)	
3.4.7.	Lightning insulation withstand voltage (wave 1.2/50 µsec) in dry conditions	750 kV
3.4.8.	Power frequency withstand voltage in dry and wet conditions	325 kV
3.4.9.	Mechanical calculation stresses	
3.4.9.1.	Safety factors of insulators routinely expected load including: - mass 100%, - rated terminal load 100% (tensile force on conductors, weight of conductors and load due to wind on conductors) - load do to wind on SA 30% (please indicate required value for each unit)	>2.1
3.4.9.2.	Safety factors of insulators rarely occurring extreme loads including: - mass 100%, - rated terminal load 50% (tensile force on conductors, weight of conductors and load due to wind on conductors), - load do to wind on SA 100%, - short circuit load 100% (please indicate required value for each unit)	>1.2
3.4.9.3.	Safety factors of insulators rarely occurring extreme loads including: - mass 100%, - rated terminal load 70% (tensile force on conductors, weight of conductors and load due to wind on conductors), - load do to wind on SA 10%, - seismic load 100% (please indicate required value for each unit)	>1.2
3.5. Name plate drawings		
3.5.1.	Each Surge Arresters, shall be provided with a weather and corrosion-proof nameplate, made of suitable material, including the mandatory markings and all data engraving by laser	
3.5.2.	Arrester identification according to IEC 60099-4/2014 Section 4.1, include Project name/ Specification No.	

4. TESTS

TECHNICAL REQUIREMENTS			
	Description	**Applicable Standard**	**Required Value**
4.1. General			
4.1.1.	Contractor shall perform Production Tests to check the quality and uniformity of the workmanship and materials used in the manufacture of the surge arrester		
4.1.2.	Contractor shall also submit test data to prove that the design has the capability to meet all the ratings as specified in Section 6 as well as relevant type test reports		
4.1.3.	The Contractor is required to submit with the tender type test reports of offered type of Surge Arresters performed by a neutral laboratory accredited to the last applicable accreditation requirements of ISO/IEC 17025/2017 by an Accreditation body which is a member of ILACMRA (eg. APLAC, EA, IAAC, A2LA). Furthermore, the Laboratory scope of accreditation must include the required specific test methods used for the above-mentioned type tests		
4.1.4.	Contractor shall submit with the test reports a list of all measuring instruments, including their accuracy class and type, test equipment and test circuits The measuring equipment shall meet the requirements of		
4.1.5.	The test reports shall include the acceptance criteria, excepted values with tolerances and the test result		
4.1.6.	The test reports shall include a description of the test method with test circuits (if applicable).		
4.1.7.	The reference to the appropriate sub-clause of the standard must include		
4.2. Type and Other Tests for Surge Arrester with Porcelain Insulator		IEC 60099-4/2014 Subclause:	
4.2.1.	Insulation withstand tests on the arrester housing		
4.2.1.1.	Lightning impulse withstand voltage test	8.2.6	
4.2.1.1.1.	To earth (kV peak)		>1.3 maximum residual voltage of the arrester at nominal discharge current
4.2.1.2.	1 min – Power frequency withstand voltage test in wet conditions:	8.2.8	

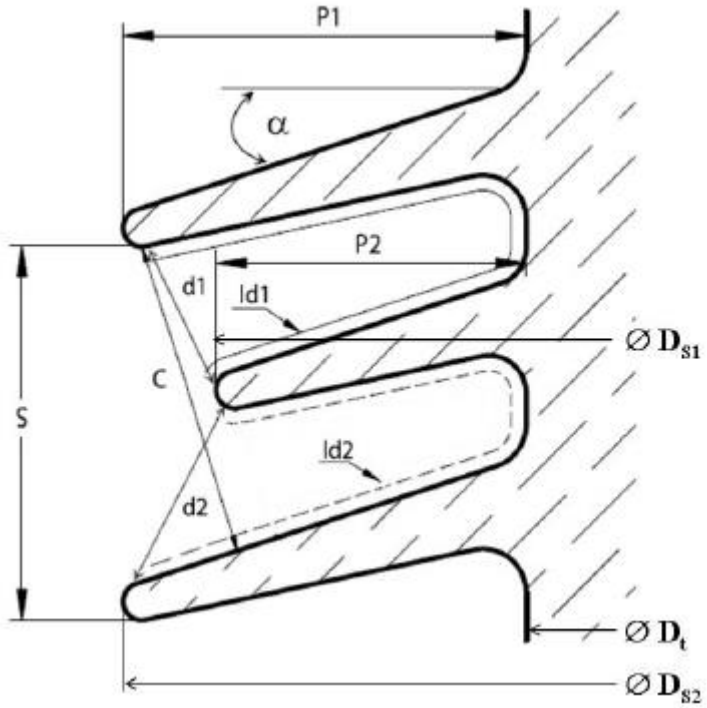
TECHNICAL REQUIREMENTS			
	Description	**Applicable Standard**	**Required Value**
4.2.1.2.1.	To earth (kV r.m.s.)		>1.06 switching impulse protection level
4.2.2.	Residual voltage tests:	6.3 & 8.3	
4.2.2.1.	Steep current impulse residual voltage test	8.3.2	
4.2.2.1.1.	Is an inductive correction is required		No/<2%/>2%& <20%/>20%
4.2.2.2.	Residual voltage at lightning impulse current wave	8.3.3	
4.2.2.3.	Residual voltage at switching impulse current wave	8.3.4	
4.2.3.	Test to verify long term stability under continuous operating voltage	8.4	
4.2.4.	Test to verify the repetitive charge transfer rating, Qrs	8.5	
4.2.5.	Heat dissipation behavior of test sample	8.6	
4.2.6.	Operating duty tests	8.7	
4.2.7.	Power-frequency voltage-versus-time test	8.8	
4.2.8.	Short-circuit tests	8.10	
4.2.8.1.	High current short circuit test	8.10.4	
4.2.8.2.	Low current short circuit test	8.10.5	
4.2.9.	Test of the bending moment	8.11& Annex G	
4.2.9.1.	Mean value of breaking load (MBL)		≥1.2xSSL
4.2.9.2.	Specified short-term load (SSL)		≥5500 N
4.2.10.	Test on insulating base and mounting bracket	8.11.6	
4.2.11.	Seal leak rate test	8.13	
4.2.11.1.	The maximum seal leak rate		$<1x10^{-6}Pa \cdot m^3/s$
4.2.12.	Radio interference voltage (RIV) test	8.14	
4.2.13.	Test to verify the dielectric withstand of internal components	8.15	
4.2.14.	Test of internal grading components	8.16	
4.2.14.1.	Test to verify long term stability under continuous operating voltage		
4.2.14.2.	Thermal cyclic test		
4.2.15.	Seismic qualification test	IEEE 693-2018 And Annex. K	Moderate level
4.2.16.	Environmental tests	8.12	
4.2.16.1.	Temperature cycling test	8.12.3.1	
4.2.17.	Salt mist test	8.12.3.2	
4.2.17.1.	Artificial pollution test with respect to the thermal stress on porcelain housed multi-unit metal-oxide surge arresters	Annex C	
4.2.17.2.	Slurry method	C.7.1	
4.2.17.3.	Salt fog method	C.7.2	
4.2.18.	Type Tests on Porcelain Insulators	IEC 62155/2003	

TECHNICAL REQUIREMENTS			
	Description	**Applicable Standard**	**Required Value**
4.3. Type and Other tests for Surge Arrester with composite insulator		IEC 60099-4/2014 Subclause:	
4.3.1.	Insulation withstand tests on the arrester housing		
4.3.1.1.	Lightning impulse withstand voltage test	8.2.6	
4.3.1.1.1.	To earth (kV peak)		>1.3 maximum residual voltage of the arrester at nominal discharge current
4.3.1.2.	1 min – Power frequency withstand voltage test in wet conditions:	8.2.8	
4.3.1.2.1.	To earth (kV r.m.s.)		>1.06 switching impulse protection level
4.3.2.	Residual voltage tests:	6.3 & 8.3	
4.3.2.1.	Steep current impulse residual voltage test	8.3.2	
4.3.2.1.1.	Is an inductive correction is required		No/<2%/>2%& <20%/>20%
4.3.2.2.	Residual voltage at lightning impulse current wave	8.3.3	
4.3.2.3.	Residual voltage at switching impulse current wave	8.3.4	
4.3.3.	Test to verify long term stability under continuous operating voltage	8.4	
4.3.4.	Test to verify the repetitive charge transfer rating, Qrs	8.5	
4.3.5.	Heat dissipation behavior of test sample	8.6	
4.3.6.	Operating duty tests	10.8.7	
4.3.7.	Power-frequency voltage-versus-time test	10.8.8	
4.3.8.	Short-circuit tests	10.8.10	
4.3.8.1.	High current short circuit test		
4.3.8.2.	Low current short circuit test		
4.3.9.	Test of the bending moment	10.8.11 & Annex G	
4.3.10.	Seal leak rate test	10.8.13	
4.3.10.1.	The maximum seal leak rate		$<1x10^{-6}Pa \cdot m^3/s$
4.3.11.	Radio interference voltage (RIV) test	8.14	
4.3.12.	Test to verify the dielectric withstand of internal components	8.15	
4.3.13.	Test of internal grading components	8.16	
4.3.14.	Weather ageing test	10.8.17	
4.3.14.1.	Salt fog test	10.8.17.2	
4.3.14.2.	UV light test	10.8.17.3	
4.3.15.	Type tests of composite insulators	IEC 61462/2007	

TECHNICAL REQUIREMENTS			
	Description	**Applicable Standard**	**Required Value**
4.3.15.1.	Design tests	IEC 61462 Subcl.7 and table 3 IEC 62217	
4.3.15.1.1.	Tests on interface and connections	7.2	
4.3.15.1.2.	Tests on shed and housing material	7.3	
4.3.15.1.3.	Tests on tube material	7.4	
4.3.15.2.	Mechanical tests	8	
4.3.15.3.	Special tests		
4.3.15.3.1.	Mechanical and electrical aging test	IEEE 987 Subcl.5	
4.3.15.3.2.	Tests on composite insulation Materials	IEC 62039/2021	
4.3.15.3.2.1.	housing materials		
4.3.15.3.2.2.	core materials		
4.3.15.3.2.3.	structural materials		
4.3.15.3.3.	Additional tests proposed by Manufacturer for silicon rubber insulator		
4.4. Routine Tests and Acceptance Tests		IEC 60099-4/2014 Subclause:	
4.4.1.	Routine tests	9.1	
4.4.1.1.	Contractor shall perform the following routine tests for each surge arrester		
4.4.1.2.	Contractor shall indicate in Routine Test Report the permissible tolerance for each test value and test conditions		
4.4.1.3.	Measurement of reference voltage at reference current		
4.4.1.4.	Residual voltage test		
4.4.1.5.	Internal partial discharge test		<10pC
4.4.1.6.	Leakage check test		
4.4.1.7.	Measurement of power losses at 0.8 times rated voltage on disks (W)		
4.4.1.8.	Current distribution test for multi column arrester. (if applicable) (kA)		
4.4.2.	Acceptance tests	9.2	
4.4.2.1.	In addition to the tests mentioned above Manufacturer shall perform on complete arresters the following tests and supply test reports accordingly		
4.4.2.2.	tests shall be made on the nearest lower whole number to the cube root of the number of arresters to be supplied		
4.4.2.3.	Measurement of power frequency voltage on the complete arrester at the reference current measured at the bottom of the arrester		
4.4.2.4.	Measurement of lightning impulse residual voltage at nominal discharge current		
4.4.2.5.	Internal partial discharge test		

TECHNICAL REQUIREMENTS			
	Description	**Applicable Standard**	**Required Value**
4.4.2.6.	Special thermal stability test		
4.4.3.	Routine and sample tests on porcelain insulators	IEC 62155/2003 Subclause:	
4.4.3.1.	Sample tests	9.2	
4.4.3.1.1.	Verification of dimensions	7.1	
4.4.3.1.2.	Porosity test	7.4	
4.4.3.1.3.	Temperature cycle test	7.3	
4.4.3.1.4.	Galvanizing test	7.5	
4.4.3.1.5.	Pressure test	8.2.2	
4.4.3.1.6.	Bending test	8.3.2	
4.4.3.2.	Routine tests	10.2	
4.4.3.2.1.	Visual examination	10.3	
4.4.3.2.2.	Electrical test	10.4	
4.4.3.2.3.	Pressure test	10.6.1	
4.4.3.2.4.	Bending test	10.6.2	
4.4.3.2.5.	Other mechanical tests	10.6.3	
4.4.4.	Routine and sample tests on composite insulators	IEC 61462/2007 Subclause:	
4.4.4.1.	Sample tests	9	
4.4.4.1.1.	Verification of dimensions	9.3	
4.4.4.1.2.	Mechanical tests	9.4	
4.4.4.1.3.	Galvanizing test	9.5	
4.4.4.1.4.	Check of the interface between end fittings and the housing	9.6	
4.4.4.2.	Routine tests	10	
4.4.4.2.1.	Visual examination	10.2	
4.4.4.2.2.	Routine pressure test	10.3	
4.4.4.2.3.	Routine mechanical test	10.4	
4.4.4.2.4.	Routine tightness test	10.5	
4.5. OTHER TESTS			
4.5.1.	In addition to the tests mentioned above, Manufacturer shall perform the following tests on one Surge Arrester and supply test reports accordingly		
4.5.1.1.	Seismic qualification test acc. to IEEE Std 693-2018 shall prove that the surge arrester including all accessories will operate fully satisfactory during and after earthquake with ground acceleration indicated in Annex K in the standard		Moderate level

5. DESIGN AND CONSTRUCTION

	Required Data and Documentation		
	Flat Alternating Sheds		
	The profile parameters shall be according to the following values		
		P_1-P_2	> 15 mm
		S/P_1	> 0.75
		C	> 40 mm
		α	7° ≤ α ≤ 14°
		D_a	< 300 mm
		K_{ad}	1
		USCD	53.7 mm/kV
		A	> 1500 mm
		CF = L/A	3.0 < CF < 4.5
		l_1/d_1	2.5 ÷ 4.5
		l_2/d_2	2.5 ÷ 4.5

P_1, P_2, S, C, α, ld_1, d_1, ld_2, d_2, D_{s1}, D_{s2}, D_t: see drawing.

$$D_a = \frac{D_{s1} + D_{s2} + 2D_t}{4}$$

L: creepage distance.

A: arcing distance.

6. REQUIRED DOCUMENTS

6.1. General

All the documents listed in the table below shall be provided.
All documents shall be submitted in DOC or PDF formats.
All drawings shall be submitted in DWG or PDF formats.
Noga-ISO reserves himself the right to require all necessary additional data, descriptions, drawings, etc. that may contribute in completing information supplied by Manufacturer about the Surge Arresters.

REQUIRED DOCUMENTS	
	Description
6.2.	ISO certificates
6.2.1.	ISO 9001 for Quality management system (QMS)
6.2.2.	ISO 14001 for environmental management system (EMS)
6.2.3.	ISO 14025 for environmental product declaration (EPD)
6.2.4.	ISO 45001 for occupational health and safety management system (OH&SMS)
6.2.5.	ISO 17025 for testing and calibration laboratories
6.3.	Static, dynamic and seismic calculation stresses according to clause 3.4.9
6.4.	Type test reports as per clause 4
6.5.	Technical documents for each item
6.5.1.	Main technical data schedule/datasheet should include: all values that appear clause 3.2 & 3.4.1-3.4.8 & drawing number & Insulator drawing number
6.5.2.	All documentation for more functions such as: pressure-relief device of an arrester, grading ring of an arrester, insulating base, monitoring device, Surge counters, Monitoring spark gaps, Leakage current indicators etc.
6.5.3.	Dimensional drawing should include: drawing number and revision number & name of materials & HV & earth terminals
6.5.4.	Manufacturer's insulator drawing should include: all values that appear in clause 3.4.1-3.4.9 & 5
6.5.5.	Name plate drawings as per clause 3.5
6.5.6.	Instruction book including description, operation, commissioning and maintenance
6.5.7.	Inspection & test plan
6.5.8.	Routine Tests and Acceptance Tests as per clause 4.4.1 &4.4.2
6.5.9.	Routine and sample test reports of insulators as per clause 4.4.3/4.4.4
6.5.10.	Seismic qualification test as per clause 4.5.1.1

Revision Control Table:

Rev	Date	Revision description	Performed by	Approved by
01	02-2026	• Created	Ron Aton	